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ARTICLE XV.

On the Difference of Longitude of several places in the United States, as determined by observations of the Solar Eclipse of November 30th, 1834. By Edward H. Courtenay, Professor of Mathematics in the University of Pennsylvania. Read October 16th, 1835.

THE interest felt by the American Philosophical Society in relation to the late remarkable Solar Eclipse, as expressed by the appointment of a committee to collect accurate observations thereon, has induced the belief that a careful calculation of some of the principal results furnished by those observations, might prove acceptable to the Society.

From the report of the committee above referred to, it appears that observations of the times of commencement and termination of the eclipse were made at Philadelphia, Baltimore, Norfolk, the University of Virginia, Cincinnati, the Friends' School near Philadelphia, Germantown, and at West Hills, Long Island, a station of the coast survey. The termination was also observed at Nashville, Tennessee. Many of these observations were made by persons whose well known skill and experience are a sufficient guarantee of the accuracy of their results; and they *all* appear to have been made with great care.

The most useful purpose to which observations of this kind are applicable, is the determination of the difference of terrestrial longitude; and although the method is doubtless inferior in point of accuracy to that of occultations, and probably to that of corresponding transits of the moon and stars, yet the results which it furnishes, when obtained

under favourable circumstances, may always be considered as near approximations to the truth, and are particularly valuable in a country like our own, whose geography must yet be regarded as very imperfect.

The difference in the results obtained by the several observers in Philadelphia, confirms the opinion, now generally entertained, that the times of commencement and termination of a solar eclipse cannot be observed with a very high degree of precision; and the same inference is deducible from a comparison of the durations of the eclipse at the several places of observation. In every case where the commencement and end have both been observed, the duration indicated the necessity of a reduction in the sum of the semi-diameters of the sun and moon, similar to that usually made for irradiation and inflexion, but the amount of this correction, as determined by the observations at different places, varies from $1''.5$ to $4''.5$. These discrepancies are undoubtedly attributable, in a great measure, to the extreme difficulty of fixing with precision the instants at which the eclipse begins and terminates.

In determining the times of conjunction of the sun and moon, the correction for irradiation and inflexion has been assumed at $3''.3$, that being the mean result furnished by all the observations which have been calculated. To ascertain the amount of this correction from the observations at each place, the observed duration was compared with that which would have occurred had such correction been unnecessary; likewise with the duration due to an irradiation and inflexion of $5''$. Then, by a simple proportion, the value of the correction was estimated.

The parallaxes in latitude and longitude were calculated by the method of the nonagesimal, and the deduced terrestrial longitude was found in every case to agree so nearly with that assumed, as to render a repetition of the calculation unnecessary. The errors in the Lunar Tables, being very nearly eliminated by the comparison of observations at different places, have been neglected.

Having adopted a mean value for the correction for irradiation and inflexion, the times of conjunction of the sun and moon, as deduced from the commencement and termination at each place, are found to differ slightly from each other. Both these times are inserted in the

first of the annexed tables, in order that an opinion may be formed as to the accuracy of the observations. It will be seen that in no case does the time of conjunction deduced from the beginning or end differ from the mean of the two results by a quantity greater than $3''.14$. In the second table are given the results obtained by neglecting the correction for irradiation and inflexion. The contents of these tables will be readily understood without further explanation.

In calculating the time of conjunction for Philadelphia, I have employed the data furnished by my own observations, but as they are perhaps less worthy of confidence than those obtained by other observers in the city, it is proper to remark that a mean of all the results furnished by the committee appointed to collect observations makes the time of commencement at Philadelphia (State House), 1 h. 0 m. 15.1 s., and that of termination 3 h. 37 m. 49.5 s.

The longitude of the State House, west of Greenwich, was assume equal to 5 h. 0 m. 43.7 s., in estimating the positions of the several places with reference to this latter meridian.

At most of the stations where observations were made, the weather is described as having been decidedly favourable; and although the instrumental means at the disposal of the several observers were probably of very different powers, yet the observations, almost without exception, are represented to have been satisfactory. At Philadelphia, the time of commencement may probably be relied on with more certainty than that of termination, as the latter was rendered somewhat uncertain by the interposition of thin fleecy clouds.

The longitude of the several places (with the single exception of Cincinnati), as deduced from these observations, will be found to differ but slightly from those given in the American Almanac, as the results of the best observations previously made.

In conclusion, it is proper to remark that I have been prevented from calculating all the observations furnished to the Society, only by the want of sufficient leisure; and that those omitted have not been neglected from any doubt as to their accuracy.

Elements employed in Calculating the Difference of Longitude, from Observations of the Solar Eclipse of Nov. 30th, 1834.

Place of Observation.	Latitude.	Commencement.	End.	Mean time at the respective places.
		h. m. s.	h. m. s.	
Philadelphia, University of Pennsylv.	39° 57' 01"	1 00 09.1	3 37 50.1	
University of Virginia.	38 02 03	0 41 11.0	3 23 43	
Cincinnati Female Academy.	39 06 00	0 03 39.71	2 49 39.71	
Baltimore, 1 mile west of Battle Mon.	39 17 12	0 51 58	3 31 29.5	
West Hills, Long Island.	40 48 47.1	1 09 53.44	3 45 18.55	
Norfolk, Virginia.	36 51 10	0 55 54.6	3 37 02.1	
University of Nashville.	36 09 32.7	not observed.	2 41 45.2	

Results obtained by assuming Irradiation and Inflexion = 3".3.

Place of Observation.	Time of Conj. from obs. of com.	Time of Conj. from obs. of end.	Mean of Times of Conjunction.	Difference of Longitude.	Longitude from Greenw.
	h. m. s.	h. m. s.	h. m. s.	h. m. s.	h. m. s.
Philad. reduced to State House.	1 47 05.87	1 47 05.35	1 47 05.61	0 00 00.00 W.	5 00 43.90
University of Virginia.	1 33 42.04	1 33 47.21	1 33 44.62	13 20.99 W.	5 14 04.89
Cincinnati Female Academy.	1 09 38.60	1 09 38.07	1 09 38.33	37 27.28 W.	5 38 11.18
Balt. reduced to Battle Monu.	1 41 25.79	1 41 22.54	1 41 24.16	5 41.45 W.	5 06 25.35
West Hills, Long Island.	1 54 02.12	1 54 04.96	1 54 03.54	6 57.93 E.	4 53 45.97
Norfolk, Virginia.	1 42 41.71	1 42 37.29	1 42 39.50	4 26.11 W.	5 05 10.01
University of Nashville.	com. not obs.	1 00 44.36	1 00 44.36	46 20.99 W.	5 47 04.89

Results obtained by neglecting Irradiation and Inflexion.

Place of Observation.	Time of Conj. from ob. of com.	Time of Conj. from ob. of end.	Mean of Times of Conjunction.	Difference of Longitude.	Longitude from Greenw.	Ir. & In. from du.
	h. m. s.	h. m. s.	h. m. s.	h. m. s.	h. m. s.	
Philadelphia, State House.	1 47 11.64	1 46 59.49	1 47 05.56	0 00 00.00 W.	5 00 43.90	3".5
University of Virginia.	1 33 47.83	1 33 41.37	1 33 44.60	0 13 20.96 W.	5 14 04.86	1 .5
Cincinnati Female Acad.	1 09 44.40	1 09 32.18	1 09 38.29	37 27.27 W.	5 38 11.17	3 .5
Balt. Battle Monument.	1 41 31.56	1 41 16.69	1 41 24.12	5 41.44 W.	5 06 25.34	4 .2
West Hills, Long Island.	1 54 07.90	1 53 59.09	1 53 03.49	6 57.93 E.	4 53 45.97	2 .5
Norfolk, Virginia.	1 42 47.48	1 42 31.47	1 42 39.47	4 26.09 W.	5 05 09.99	4 .6
University of Nashville.		1 00 38.47	1 00 38.47	46 21.02 W.	5 47 04.92	

By comparing the results furnished by these two tables it will be seen that although the times of conjunction deduced either from the commencement or end, when the correction for irradiation and inflexion is applied, differs considerably from that obtained when this correction is neglected, yet the mean of the times of conjunction in the former case differs almost imperceptibly from that in the latter, and the differences of longitude resulting from the two methods of calculation are almost identical.